



Unleashing Digital

Oil, gas and energy companies are tapping digital technologies to gain competitive advantage.

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As digital technologies upend profit pools in consumer-facing industries, oil, gas and energy executives have until recently been skeptical of its disruptive power in their sector. Many executives focus on what they have done well for decades: employing data analytics to improve operations, and relying on siloed applications that offer only limited visibility across the organization. Greater disruption is now quickly arriving in the oil, gas and energy industry. The winners will learn to combine the power of operational improvements with the organizational change required to unleash the full digital potential.

It's easy to see why so many people view companies like Amazon, Netflix and Airbnb as the business models of the future. They've redefined their industries and the customer experience, all while maintaining a culture of innovation and setting the pace for the rest of the market.

None of this is news to oil, gas and energy executives, but they also know that what works in the consumer realm won't easily translate across their industry. Take the concept of failing fast: That's not an option in refining or offshore drilling. Moving quickly? It's just beginning to happen for the next generation of projects. Anticipating profit pool shifts and scaling technologies to re-define the industry? Easier said than done.

Differences like these feed the notion that digital is more hype than reality—which, unfortunately, can obscure the truth that digital technology is transforming the energy sector in immensely significant ways.

To ride that wave of change, and to avoid being swept under by it, oil, gas and energy executives will have to understand the nature of digital transformation and how it affects their industry and their companies. They will need to take proactive steps to ensure they maintain competitive advantage. This brief outlines an approach centered on three key imperatives.

- Align the digital doers and the dreamers in your organization, the pragmatic realists and the visionaries.
- Adopt a holistic approach to digital strategy.

- Address the *what* as well as the *who* and *how* while making progress in discrete waves and small steps.

Aligning doers and dreamers

When it comes to digital strategy development, most leadership teams have doers and dreamers. Doers are focused on the here and now, comfortable with the status quo. With half the energy workforce poised to retire over the next decade, these pragmatists want to maintain and improve the processes and systems they know. They may view digital, along with the work and change it represents, with skepticism. By and large, they would prefer to continue to focus on operational excellence, with minimal disruption.

Dreamers see the long term. They want to understand and define the full spectrum of ways digital could transform operations, explore new profit pools or open opportunities to become the disrupter.

Both perspectives are critical, but when the two groups are left in unmanaged opposition, the tension can be paralyzing. An effective strategy-development process strikes a balance between the doer and dreamer perspectives, seeking out agreement where it may already exist.

As they integrate these perspectives into the strategic vision, executives should consider several key signposts that mark new opportunities while also signaling the constraints that the industry works within.

- **Today is measurably different from prior eras.** The confluence of smart devices, low-cost networks and massively powerful cloud-based computing has changed the calculus of running a business at every level of the organization. In such an environment, it is not only possible to think big but dangerous not to. Having the capacity to scale up what works is key.
- **The direction of disruption is knowable.** The contours of disruption are very often discernible long before disruption occurs. Autonomous vehicles, advanced subsea robotics and the digital oilfield—all were visible and widely discussed decades before they began to emerge as realities. Leaders need to

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grasp how digital trends could affect the industry and use this knowledge to form a point of view on the future.

- **Profit pools will shift.** Digital innovation will change who is making money and how (see Figure 1). In upstream, people wonder how digitalization and proprietary digital platforms will shift share between equipment and service providers and their customers. Emerging digital service providers will participate in this landscape, either as standalone entities that take share from existing participants, or as acquisitions folded into the traditional players.
- **Ecosystems make all the difference.** Oil, gas and energy companies are accustomed to operating in joint ventures. Consider the offshore production sector (see Figure 2). Everyone in the industry can agree on facets of what the digital future should look like: a model of efficiency with state-of-the-art platform control and safety systems; modern and partially modularized subsea pro-

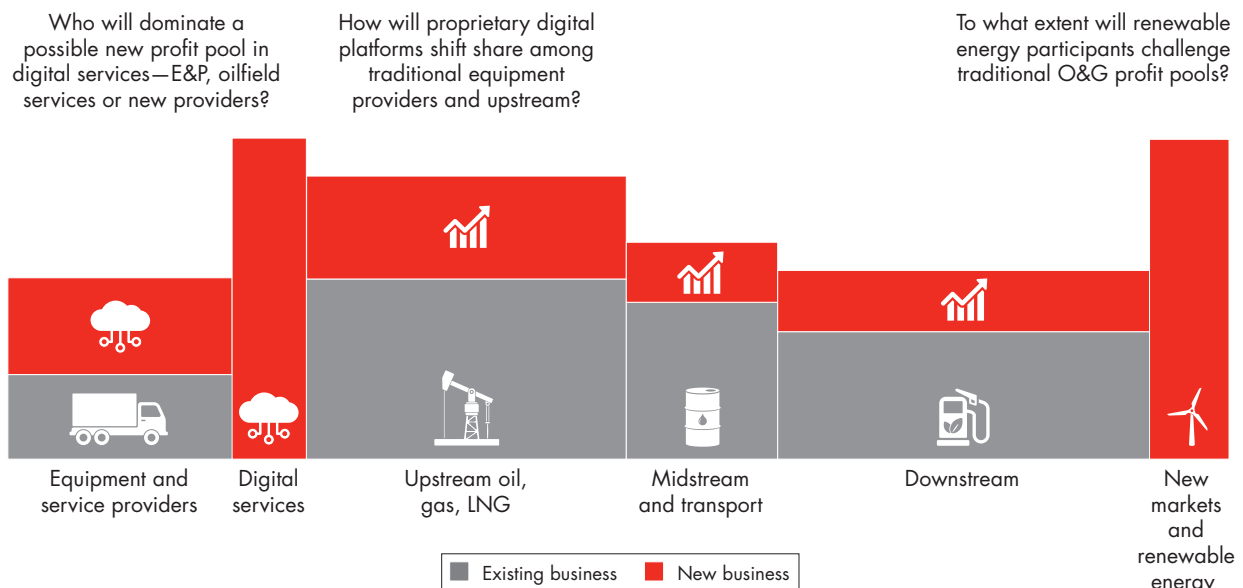
cessing equipment; largely remote operations; and real-time, fieldwide data flows that enable optimal trading and marketing of volumes. But many issues limit the pace and scope of innovation, including regulation, expensive equipment with long life cycles, aging technical infrastructure and very real concerns about the ownership and sharing of data. These factors offer some protection against disruption. But they also present executives with hard choices about what a workable strategy looks like.

A holistic approach to digital transformation

Analytics are nothing new to oil, gas and energy companies. Their businesses have long depended on rich pools of data to discover and deliver new value: Reservoir modeling uses massive amounts of data and has improved steadily since the 1960s, and refineries have used dynamic process optimization modeling to improve uptime since the 1980s.

Figure 1

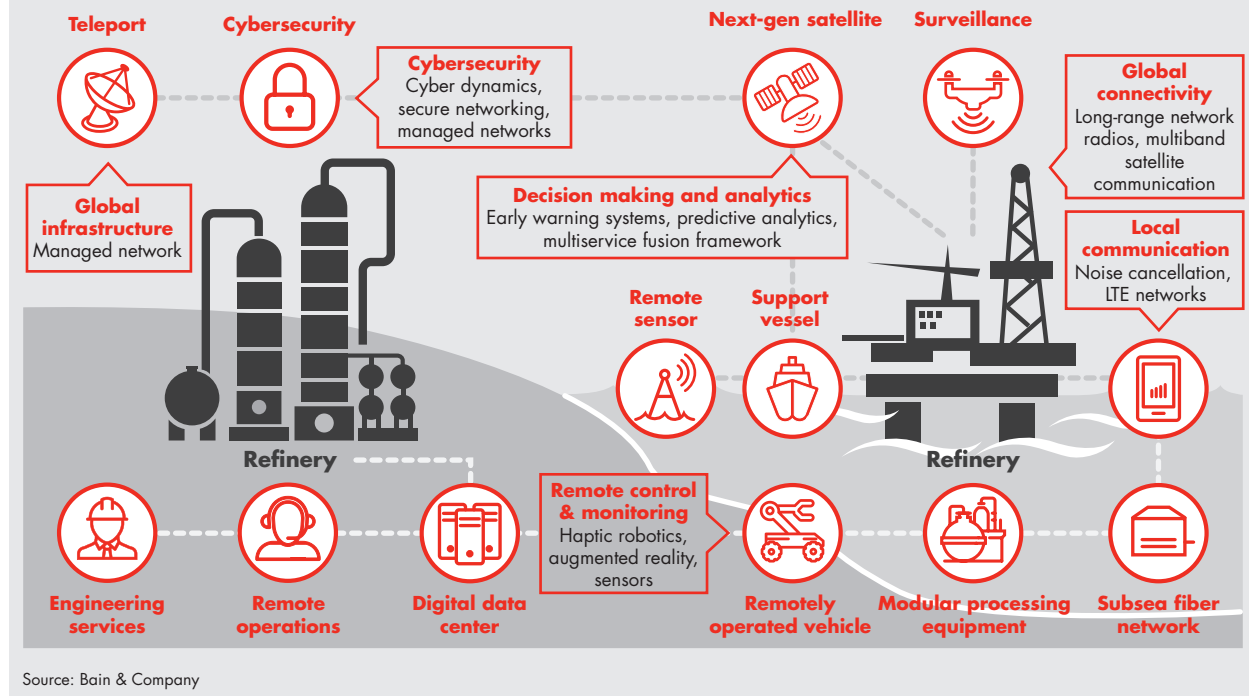
Digital innovation will shift profit pools in oil and gas—although exactly how remains to be seen



Source: Bain & Company

Figure 2

The offshore field of the future is a complex ecosystem



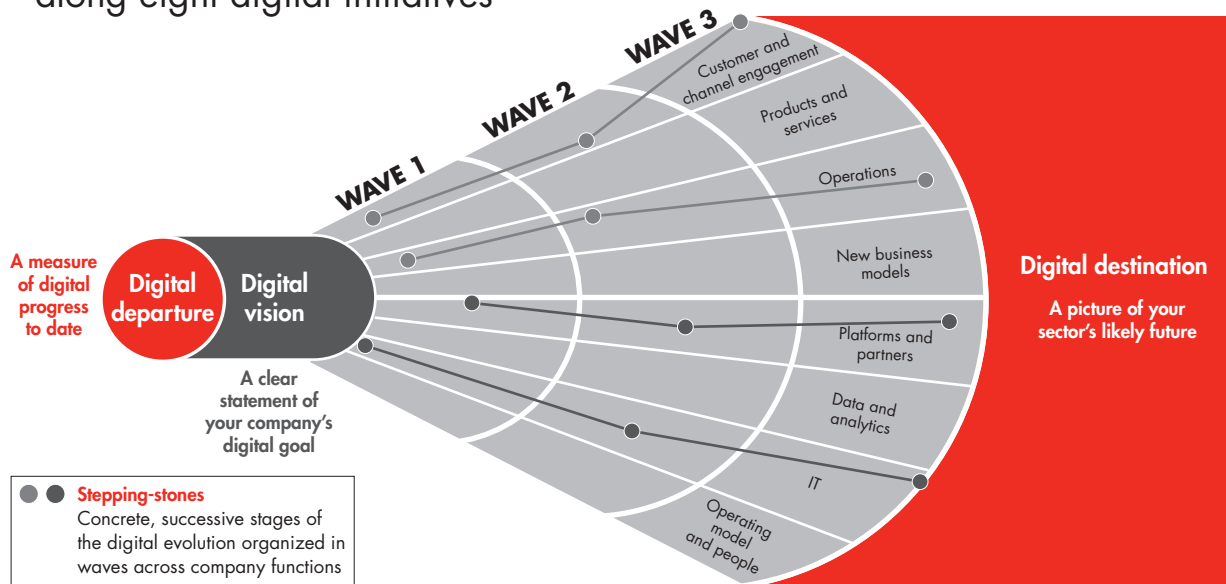
The drawback of a static approach would be that it relies too much on existing processes and business models, missing new opportunities available through rapidly evolving digital technology and advanced analytics.

To capitalize on the strengths of existing processes and build the capabilities necessary to meet new goals, four key principles can guide the implementation of digital strategy (see Figure 3).

- Narrow the field of vision.** Some companies have more initiatives than they can track, and this scattershot approach steals attention from the efforts with the most potential to scale and create significant value. Defining a clear destination helps focus—and here the dreamers play a critical role. Equally important is assessing the starting point, understanding what the company is already doing right and where it needs to invest in building up capabilities.
- Organize along pathways.** Companies gain momentum by focusing their digital activity along *path-*
- ways, each of which encompasses an aspect of the business.** The first four of these—the *what*—support the underpinnings of the organization: stakeholder and channel management, products and services, operations and new business models. These are areas of traditional strength for the oil, gas and energy industry, which is good at capturing data and developing use cases. The other pathways—the *who* and *how*—are organizational enablers: developing the right digital platforms and partnerships; developing capabilities to bring data varying in volume and formats with analytics into decision making; embedding the talent, culture and operating model to support digital success; and rebooting the IT backbone to free it from its slow-moving legacy past. These are areas where oil and gas companies have drastically underinvested to date.
- Chart progress with stepping-stones.** The experience of consumer-oriented digital leaders demonstrates that companies don't become disruptive overnight. They advance their digital vision through a series

Figure 3

Companies that understand their starting point and can define the likely future of their sector can progress through small steps toward their goals along eight digital initiatives



Source: Bain & Company

of steps. They may group these steps into successive waves, with the overall strategy evolving as new information emerges.

- **Adapt rapidly to change.** Technology evolves quickly. To succeed in a dynamic, digital environment, executives need to be agile and adaptable in their processes and strategies, nurturing successes and letting go of failures. Success will require breaking old habits and evolving operational management systems and organizational culture.

Pathways to a digital destination

Pathways are the steps that companies take to make progress on various digital initiatives. These paths rise on waves of evolution as the company makes progress on their journey to a digital destination—that is, their defined vision of the sector’s likely future. As shown in Figure 3, we’ve identified eight major initiatives—four that define what companies do, and four that define who does it and how it is executed.

The what

Oil, gas and energy companies have made good progress digitalizing operations and products (see Figure 4), but much work remains integrating front- and back-end solutions. Successful integration will entail greater visibility to data, and a shift is already under way that broadens the centers of influence within energy companies. Previously, only those with access to the system of record (financial or operational) could influence decisions. Increasingly, systems allow greater access to data and the relevant insights drawn from them, decentralizing decision making and power. These insights help connect and optimize operations in what Baker Hughes, a GE company, calls a Fullstream Digital Approach.

Stakeholder and channel management. Companies like Amazon and Airbnb exert a great deal of their digital energy in deepening customer insights for personalization, convenience, speed and transparency. In retail, companies are already applying an array of digital solutions like store locators, robotic fuel dispensation, mobile

payment, digital billboards, smart pump advertising and more.

However, a different approach is required in the regulated, B2B, commodity-based realms of upstream, midstream and refining, where the focus must expand beyond customers to a wide array of stakeholders, including suppliers, governments, regulatory bodies and local communities. Digital tools can improve the efficiency and effectiveness of third-party interactions, from supplier contracting and performance management to regulatory compliance, and royalty and tax payments to governments. “Digital twins” of production and manufacturing assets can deliver a new level of insight on operations. Companies are beginning to link multiple systems together, allowing stakeholders to access data and metrics from a wide range of domains, including health, safety and compliance reports.

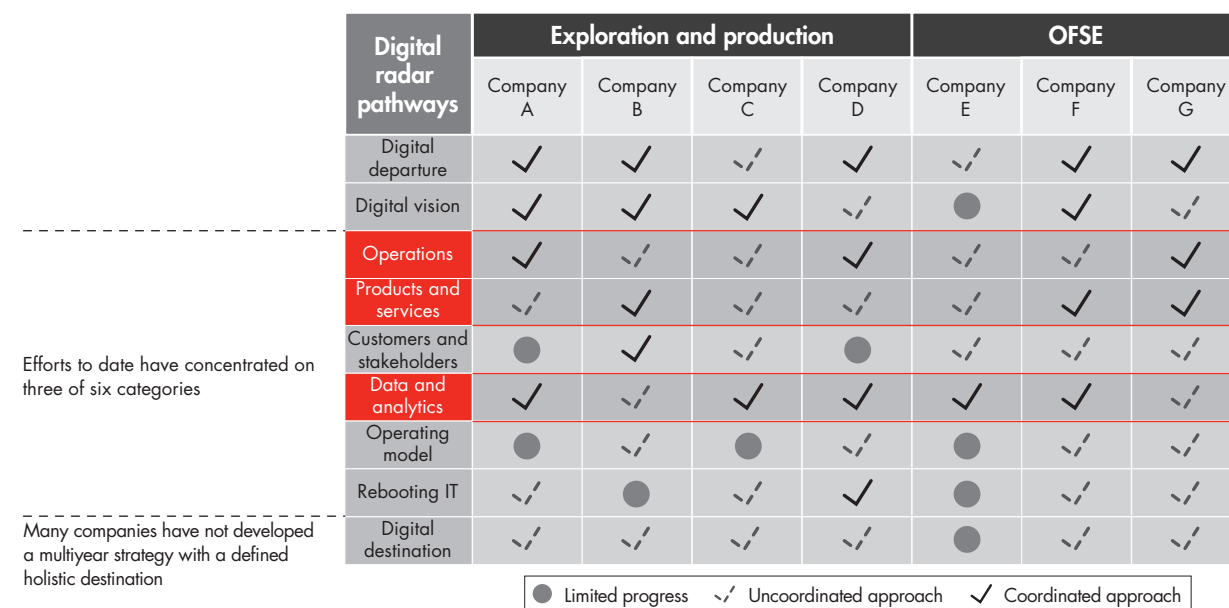
Products and services. New products and services are emerging that improve decision making, resource management and well optimization, and these are dis-

rupting old models and shifting profit pools. Solutions like integrated upstream optimization, integrated rock and fluid solutions and real-time field-development plans are making oil, gas and energy organizations more intelligent, reducing cycle time and costs, and increasing profitability. Some solutions deploy smart sensors or other Internet of Things hardware that make it easier to access new data, allowing better decision making—for example, by identifying assets at risk for failure and taking proactive rather than reactive action.

Operations. Field and plant level access to decision analytics, remote monitoring of wells and optimization of key systems and employee tasks enable oil, gas and energy companies to improve operational efficiency, predict short- and long-term operational failure and take data intelligence to the field or plant service level. However, the right intelligence must be accessible in real time and in the right place to be effective. For example, the field or plant workforce should be equipped with mobile apps that have real-time access to service contracts, prior incident reports and other important information.

Figure 4

Upstream and oilfield service companies have made good progress digitalizing operations, but still lack a holistic approach



Sources: Public company filings; Bain & Company

A FULLSTREAM APPROACH

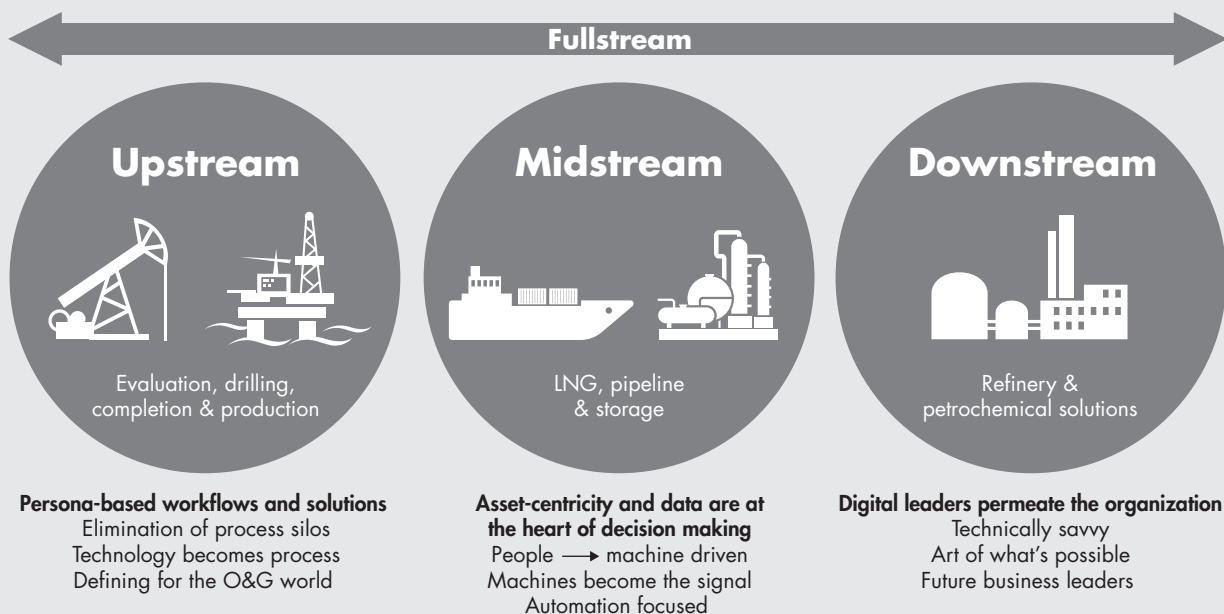
A Fullstream approach brings together equipment, services and digital solutions across the full value chain of oil and gas activities—from upstream to midstream to downstream. Fullstream capabilities unlock new sources of value by combining knowledge, experience and technology to produce smarter approaches and better outcomes. Oil and gas companies can unite reservoir logging, evaluation, drilling, well completion, equipment, production and process data with the power of a Fullstream portfolio. They can achieve a step change in productivity across upstream, midstream and downstream assets, people, processes and systems. By removing silos and connecting data, insights and self-learning models across their operations, oil and gas companies can increase capital efficiency and profitability, decrease marginal costs and manage resources.

Digital convergence with Fullstream

Digital transformation represents a true convergence of operations, processes, ecosystems, people and systems, comprising field development planning, optimizing production, reducing risk through leak detection, and driving downstream throughput and efficiency. Fullstream Digital, as envisioned by Baker Hughes, a GE company, can transform the oil, gas and energy industry by connecting data silos, providing users with the information they need on a single screen, and a digital workspace that fosters collaboration across work functions.

Figure 5

A Fullstream Digital approach to data and decision making can optimize operations and bridge the digital and industrial worlds



Source: Baker Hughes GE

The views expressed here are those of Baker Hughes GE and do not imply endorsement by Bain & Company.

IMPROVING PERFORMANCE THROUGH BETTER DECISION MAKING—A CASE STUDY

A large integrated oil company (IOC) was looking for ways to identify the amount of crude oil and natural gas in an underground location, determine which recovery mechanisms to implement and predict reservoir recovery factors over time. It explored several solutions to help executives make better decisions.

Better decision making can also help compress timelines. While it generally takes at least five years from planning to first drill of a well, producers can accelerate this process by using highly detailed models of rock properties, fluid distribution, volumetric calculations and other data. Planning tools like JewelSuite from Baker Hughes, a GE company, can help oil and gas operators make better strategic decisions, while delivering more accurate estimates of time to revenue.

With its innovative modeling technology, JewelSuite allowed the large IOC to speed up the modeling process, enabled it to analyze alternative outcomes by running multiple scenarios, facilitated collaboration among multi-disciplinary teams and gave decision makers greater confidence in their field development plans.

OPTIMIZING OILFIELD SERVICES WITH BETTER PREDICTIVE DATA—A CASE STUDY

An oilfield services and equipment (OFSE) company was looking for ways to achieve maximum asset utilization and lifetime, reduce costs by servicing equipment at the right time for the market, and maintain compliance standards for safety, regulatory and environmental requirements. After evaluating several technologies that optimize workflow, enhance productivity, improve efficiencies and reduce mounting field service operation costs, executives chose GE's ServiceMax.

ServiceMax helps oilfield service companies execute fast, effective and safe field service. Its cloud-based platform is built for a mobile and inherently remote workforce. ServiceMax manages preventative maintenance, scheduling, work orders, field tickets and contracts for a seamless operation with zero non-productive time. Field engineers and technicians can tap institutional knowledge from anywhere at any time to help troubleshoot equipment issues or assist with a service they are providing for the first time. Scheduled optimization helps ensure the right field engineer is assigned to the right job with the right equipment. Checklists are digitally completed to help ensure each critical step is captured for a safe, compliant and efficient service operation. Field engineers can complete their field tickets onsite using speech recognition and capture electronic signatures so field tickets are delivered while engineers are still in the field.

ServiceMax provided the OFSE customer with advanced data analytics that helped improve operational efficiency and prevent unscheduled downtime. Its early warning system delivers advance notice well ahead of any equipment failure, and continuous prediction capabilities tap historical operations data to predict future events that could impact normal operations over the short term while optimizing operational decisions over the long term.

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New business models. For some companies, digital goes beyond improving the existing business model, creating new, standalone, revenue-generating businesses. Senior managers should prepare for these new business ventures by taking specific actions.

- **Brainstorm new scenarios.**
 - How would the arrival of significant venture capital in my industry or a supporting industry affect my position?
 - What type of disruptions could overhaul the industry?
 - What new customer groups, with different needs, are out there?
- **Question your competitive advantage.**
 - Which capabilities do I need to invest in to sustain my competitive advantage?
 - Do I need a new business model, or can I evolve my current one, to ensure my competitive advantage?
 - Are there new capabilities or proprietary assets I need to buy, partner or build?

The who and how

A transformative shift is under way in the energy industry. Within a few years, successful energy companies will rely on fewer people, many of whom have different skills than today’s workers. These changes will shift profit pools, but the high barriers to entry make it difficult for disrupters to upend today’s major resource owners. Leaders will continue to compete with one another, taking market share as they are able to, based on their ability to execute more efficiently and effectively. However, as data ownership and infrastructure access become more valuable, things could change.

Platforms and partners. In the digital world, choosing and building platforms and partners are essential strategic decisions. It is critical to define core strengths and

decide where to compete and when to partner. Differentiation and specialization are likely to become increasingly important, and defining relationships with partners, including the limits of overlap, will be critical.

- **Get comfortable collaborating with new partners and customers.** Some digital systems can succeed only if they integrate well with third-party systems. Executives should anticipate complexities that might hinder such integration. Team leaders should work closely with customers, strategic partners and suppliers to manage any discrepancies in capabilities or data compatibility, in order to accelerate outcomes.
- **Treat stakeholders like virtual customers.** In the complex ecosystems of suppliers and partners, successful companies are able to create more value when they understand what each party wants and how to deliver against those as efficiently as possible.
- **Create “no-fly zones” to protect your core.** While collaboration is at the core of digital strategy, external collaboration can also create competitive risk. For example, during a period of strong collaboration between two technology leaders in the mid-2000s, one realized that the other was—within their rights—using co-created learnings to compete directly with its own offers. Successful execution of this strategy requires keen self-awareness about the business’s core today, and how the market and strategy will migrate that core into tomorrow.
- **Develop platforms that are scalable and easy to build upon.** Platforms are only valuable once a critical mass of users on all sides is reached. Therefore, platforms should be designed and launched in a way that most efficiently enables this critical mass to be reached. A scalable and non-agnostic platform that is easy to develop upon can ensure company adoption.

Data and analytics. Leveraging data analytics creates insights that help organizations increase efficiency, boost profitability, reduce costs and effectively manage

resources. Oil, gas and energy companies use these insights to track the health of their facilities, analyze production flow and well patterns, and develop a deeper understanding of well history and dependencies. Understanding historical data can improve forecasting abilities.

Intelligence in the right hands at the right time eliminates guesswork. A personal dashboard lets operations leaders see workflows, efficiency data, cost projections and payroll statistics. The dashboard for a leader in human resources or finance would present data insights relative to their needs and expertise.

Data is most effective when it is central to process, accessible to the right people and seamlessly integrated into workflows and everyday routines. For example, data can connect field development planning with modeling by providing key subsurface insights before drilling begins. Data can also help optimize production, ensure continuous process management and support the maintenance and servicing of the wells, assets and infrastructure. End-to-end full cycle loops like this work

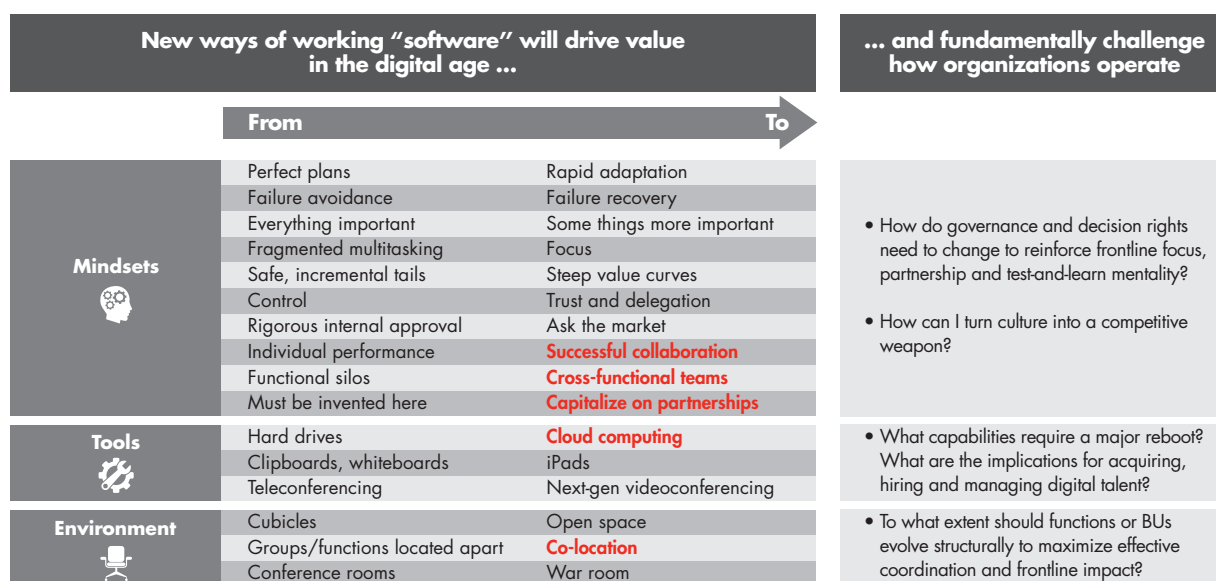
only when there are no data silos, allowing the entire operation to work seamlessly together. Operational silos must be broken down to reduce costs, improve efficiency and facilitate cross-company innovation.

With data at the heart of decision making, and interdependencies connected and shared (Fullstream, enterprisewide), we can identify opportunities for more efficiency, using machine learning to signal a need for human review and decision making. These first steps to automation free up engineers, operators, plant managers and others to dedicate increasing time to making data-driven, informed decisions.

Operating model and people. The way work gets done needs to change. Initiatives targeting operating model improvements often start with questions about the hard elements, the org chart that connects people to one another in an organization. Exploration and production (E&P) companies, for example, commonly approach operating model issues by first debating the trade-offs between functional- and asset-oriented organizational

Figure 6

A shift of emphasis to soft elements—how people get things done, how the culture adapts to digital—will create value in the digital age



Source: Bain & Company

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models. Leaders in digital generally take a different approach: They tend to embed new soft elements first—how people get things done (the operating management system), how the culture adapts to digital. This shift toward soft elements—decision rights, accountabilities, culture, ways of working—reflects a new set of activities that will drive value in the digital age, based on four digitally driven trends (see Figure 6).

- **Business boundaries are evolving** as operational realities shift and profit pools migrate cash flows.
- **Culture is emerging as a source of competitive advantage.** Rapid adaptation, short-cycle feedback loops and networked collaboration all require decision making to migrate toward the front line.
- **Increased cross-unit and external collaboration is a source of value creation,** placing a premium on accountabilities and governance over reporting lines.
- **All executives must be digital leaders.** For an organization to become more digitally savvy, executives

must tap the entire talent pool, scale learnings from the highest performers, and empower everyone with the tools they need to make data-driven decisions.

Rebooting IT. Obstacles arise when companies try to connect digital initiatives with legacy IT systems and databases, many of which have been in place for decades. It can be difficult for new, digital solutions to access the data stored in these old systems, and the IT staff is often ill-equipped to manage the transition.

Finding a digital platform that integrates well with existing systems is critical. Even so, embedding new software typically requires a reboot of capabilities, not only in digital-specific areas, but across the organization. Executives should identify a few critical capabilities to invest in building digital leadership within the IT organization.

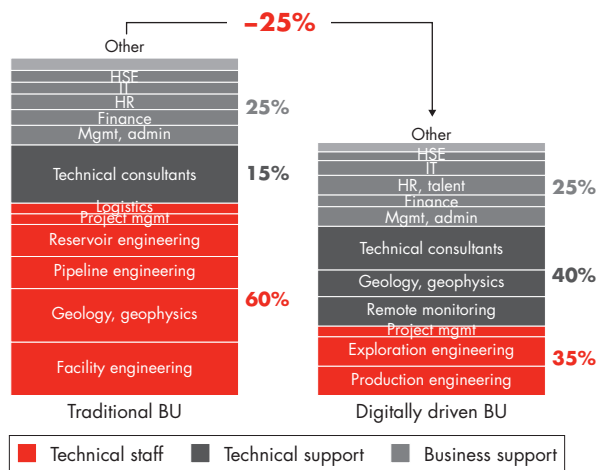
The transformation to digital is likely to create structural changes in IT, too: New operational realities, participation models and ways of working require the hardware to transform to deliver. For example, in a digitalized indus-

Figure 7

Digitalization will change the operating model and organizational structure of oil and gas companies

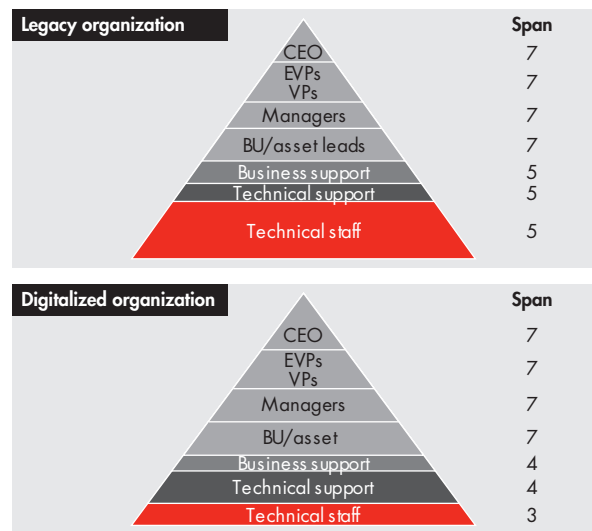
Digitalization will reduce staff size and compress organizational layers ...

Illustrative example of business units in an integrated oil company, full-time equivalents



Source: Bain & Company


... as well as compress the spans within support functions



trial organization, fewer on-site personnel are required due to automation. More of those remaining will perform data management tasks (often remotely), and many low-risk or noncore activities can be outsourced at reasonable cost. These realities change the shape of an organization, and often require updated organizational scaffolding (see *Figure 7*).

Companies are beginning to recognize that updating their legacy systems, data, operating models and skills are a priority. A Bain & Company survey of 150 technology decision makers found that at the more digitally savvy companies, IT planned to spend about 45% of its budget on activities that would grow the business, compared

with only 20% of the IT budget devoted to that growth at more traditional companies.

Digital will not change everything. Humans will still need to make decisions, industry experience and competence will remain the bedrocks of success, and personal relationships and effective communication will continue to grease the gears. But those oil, gas and energy executives who embrace what is different—aligning the doers and dreamers, adopting a holistic approach, being dynamic—will position their organizations not only to keep up with digital, but to unleash its full potential. 

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